

Chapter 10

Agriculture and Important Farmland

10.1 Affected Environment

This section describes the affected environment related to existing agricultural land uses, Important Farmland, Williamson Act contract lands, and forest resources in the primary and extended study areas. See Chapter 12, “Botanical Resources and Wetlands,” for detailed definitions of forest land habitats and Chapter 13, “Wildlife Resources,” for a discussion of the relationship between agricultural land uses and wildlife uses. See Chapter 17, “Land Use and Planning,” for a discussion of existing land uses within the primary and extended study area and the project’s consistency with existing land uses.

10.1.1 Agriculture

Shasta Lake and Vicinity

The setting for agricultural resources in the Shasta Lake and vicinity portion of the primary study area consists of areas in Shasta County north of Shasta Dam, including lands surrounding the lake, that would be subject to inundation and areas where infrastructure would be removed, modified, or relocated under the five action alternatives.

Shasta Lake is surrounded by mountainous and rugged terrain. There are no known agricultural uses adjacent to the lake or in its immediate vicinity above Shasta Dam.

Upper Sacramento River (Shasta Dam to Red Bluff)

The upper Sacramento River portion of the primary study area consists of the portion of Shasta County south of Shasta Dam and downstream to Red Bluff in Tehama County. The valleys of the Sacramento River and its tributaries (Churn, Cottonwood, Anderson, Stillwater, Cow, Bear, Battle, and Clover creeks) contain some of the most productive agricultural land in Shasta and Tehama counties. In addition to the high quality of their soils, agricultural lands in this area enjoy a long growing season of 172-205 days. Water from the Anderson-Cottonwood Irrigation District (ACID), surface diversions of streams, or groundwater is available and good transportation access exists (Shasta County 2004). As of 2002, Shasta County’s 1,126 farms encompassed a total of almost 333,828 acres and Tehama County’s 1,573 farms were located on 862,440 acres. About 20,000 acres of Important Farmland are located in the Sacramento River corridor between Shasta Dam and the Red Bluff Diversion Dam. Please see Section 10.1.2, “Important Farmland,” below for further discussion.

The majority of agricultural activity is located on the Sacramento Valley floor in the south-central portion of Shasta County and across central Tehama County. Small pockets of pastureland exist throughout Shasta County, including mountainous regions. Based on production value, the largest use of agricultural land in Shasta County is field crops, followed by livestock. Nursery stock is the third largest use. Approximately 13 percent of Shasta County land is devoted to some type of agricultural use.

Agricultural uses in the Tehama County portion of the Sacramento Valley consist mostly of orchard and nursery plant operations. The primary crops of Tehama County orchards are walnuts, prunes, almonds, or olives. These crops are largely concentrated in the floodplain alongside the Sacramento River (within and below the upper Sacramento River portion of the primary study area) and are irrigated with groundwater, as well as surface water from local creek diversions and the Sacramento River.

A drastic increase in orchard acreage has occurred since orchard production was initially reported by the National Agricultural Statistics Service in 1930. A combination of factors is responsible for this increase: the availability of irrigation water, advances in irrigation technologies, relatively good commodity prices for orchard crops, and the availability of processing facilities.

The upper Sacramento River portion of the primary study area (areas below Shasta Dam) is largely serviced by ACID. ACID's service area of approximately 32,000 acres extends south from the city of Redding in Shasta County into northern Tehama County. ACID does not provide water for municipal and industrial uses in these areas. Approximately 90 percent of ACID's customers irrigate pasture for haying or livestock; however, in most of the river corridor the water is used to irrigate orchard and other food crops. In total, ACID's service area accounts for about two-thirds of all irrigated pasture in the Redding basin.

ACID uses a rotation schedule to deliver irrigation water to its customers. Very little groundwater is used within the district for agricultural purposes, except occasionally during drought years. Water requirements are typically highest during summer (June, July, and August) because of the area's hot, dry climate. A groundwater management program is being developed; by 2005, 12 dual-completion groundwater monitoring wells had been installed within ACID boundaries. The small portion of groundwater used is limited primarily to deciduous crops and is pumped by privately owned wells. ACID's facilities and irrigation are important contributors to groundwater recharge in the Redding basin. Annual seepage associated with the ACID Main Canal is estimated to be approximately 44 thousand acre-feet (TAF).

Agricultural use within ACID's service area is primarily pasture, in addition to alfalfa and some deciduous orchard crops. Pasture use is typically in the range of 75 percent of the total crop mix served by ACID. Annual cropping patterns

have not varied substantially since the mid-1970s. Therefore, associated on-field water requirements and diversions for crops have been more a function of water-year type and climate than changes in cropping.

Agriculture thus accounts for an important segment of the economic base of Shasta and Tehama counties. In 2002, for example, the total market value of farm products in Shasta County was \$52,197,800, a slight increase from the \$51,691,000 produced in 2001. Minor increases in the annual production value of orchard crops and apiary products accounted for this increase. Field crops accounted for nearly 40 percent of this total, with livestock sales providing nearly one-third (32.1 percent) of the county's total agricultural production value. Shasta County ranked only 42nd among the 58 California counties in 2002 in the value of total agricultural production – \$44,477,000, as reported by the California Department of Food and Agriculture (Shasta County 2004).

In addition to its economic contribution, the agriculture industry is in large part responsible for the rural character of Shasta and Tehama counties. Farmland can also play an important role in the support of wildlife values through the effects it has on conservation of wildlife habitats. As more farmland is developed for urban and suburban uses, the available habitat for most field and woodland edge species decreases, resulting in a subsequent decline or potential elimination of their populations. Agricultural lands also provide productive, privately maintained open space that contributes to the open, natural landscape of much of Shasta and Tehama counties.

Lower Sacramento River and Delta

The Sacramento River below Red Bluff Diversion Dam and its tributaries continue to provide water to crops grown in the river's floodplain and the valley floor, which broadens as it expands into the Central Valley. The river crosses Tehama, Butte, Glenn, Colusa, Sutter, Yolo, and Sacramento counties and is an important source of water for the irrigation and agricultural districts in those counties.

California's Central Valley is home to more than 4 million people; agriculture is the most important segment of the region's robust economy. The Sacramento and San Joaquin river basins provide drinking water for more than two-thirds of Californians and irrigation water for California's crops. The availability of irrigation water makes the Central Valley a major source of reliable, high-quality crops, such as almonds, walnuts, grapes, tomatoes, rice, and other orchard, vineyard, and field crops, marketed to the nation and the world (Reclamation and DWR 2005; DWR and Reclamation 2006).

As of 2002, California's 79,631 farms included a total of 27.6 million acres (NASS 2004). Of that acreage, the Sacramento Valley had more than 11,000 farms with about 4.3 million acres. Sacramento Valley portions of the Central Valley's watersheds support a wide variety of agricultural uses, including livestock grazing, irrigated grain and vegetable crops, and orchards (DWR and

Reclamation 2006). Most agricultural water demands in the Sacramento Valley are met in average water years. Farmers have been growing more crops per acre-foot of applied water by improving productivity and efficiency. However, in some areas, water sources once used for agriculture are now used for urban needs, environmental restoration, and groundwater replenishment. During droughts, water supplies are less reliable, heightening competition and at times leading to conflicts among water users. Water quality is degraded, making it difficult and costly to make the water drinkable. Irrigated agriculture and related businesses are adversely affected, in turn affecting California's economy. During droughts, groundwater levels decline, pumping costs increase, and many rural residents who depend on small water systems or wells run short of water (DWR and Reclamation 2006).

Table 10-1 provides examples of water supply distribution among uses in recent wet, above-normal, and dry years.

Delta agricultural lands were "reclaimed" when levees were constructed and marshy areas were drained. In less than 100 years, from 1850 to 1930, hundreds of thousands of acres of land went into agricultural production. Historically, asparagus, corn, alfalfa, and sugar beets were the Delta's dominant crops. However, a wide variety of crops have been grown in the Delta. In 2008, the Delta's main crops were corn, alfalfa, tomatoes, and wine grapes (DWR 2009).

CVP/SWP Service Areas

The CVP is the largest water storage and delivery system in California, covering 29 of the state's 58 counties. Operated by Reclamation, the CVP consists of 21 reservoirs capable of storing 12 million acre-feet of water, 11 powerplants, 500 miles of major canals and aqueducts, and many tunnels, conduits, and power transmission lines. The CVP irrigates about 3.25 million acres of farmland and supplies water to more than 2 million people through more than 250 water districts, individuals, and companies through water service contracts, Sacramento River water rights, and San Joaquin River exchange contracts. Most of the CVP service area is inside the Central Valley. About 90 percent of the south-of-Delta contractual delivery is for agricultural uses (Reclamation 2007).

The CVP plays a key role in California's economy, providing water for six of the top 10 agricultural counties in the nation's leading farm state. The CVP provides about 5 million acre-feet of water for farms, which is enough to irrigate about 3 million acres, or approximately one-third of the agricultural land in California (Reclamation 2009).

Most of the population of the CVP service area is concentrated within urban areas. The CVP service area includes various municipal and industrial water contractors and water districts that serve portions of the Sacramento and Stockton metropolitan areas and the San Francisco Bay Area (Reclamation 2007).

Table 10-1. California Water Balance Summary

Category	State Summary (MAF)			Sacramento River (TAF)			San Joaquin River (TAF)		
	1998 (171%) ^a	2000 (97%) ^a	2001 (72%) ^a	1998 (168%) ^a	2000 (105%) ^a	2001 (67%) ^a	1998 (171%) ^a	2000 (97%) ^a	2001 (72%) ^a
Total Supply (Precipitation and Imports)	336.9	194.7	145.5	90,351	58,217	36,564	40,727	28,497	20,010
Total Uses, Outflows, and Evaporation	331.1	200.5	159.8	86,859	59,469	40,124	38,922	28,527	22,707
Net Storage Changes in State	5.8	-5.8	-14.3	3,492	-1,252	-3,560	1,805	-30	-2,697
Distribution of Dedicated Supply (Includes Reuse) to Various Applied Water Uses									
Urban Uses	7.8	8.9	8.6	727.3	859.6	877.2	562.5	594.0	622.8
	(8%)	(11%)	(13%)	(3%)	(4%)	(5%)	(5%)	(5%)	(6%)
Agricultural Uses	27.3	34.2	33.7	6,458.2	8,713.9	8,567.1	5,458.1	7,034.1	7,154.2
	(29%)	(41%)	(52%)	(27%)	(38%)	(45%)	(47%)	(57%)	(67%)
Environmental Water ^b	59.4	39.4	22.5	16,397.8	13,487.6	9,587.7	5,604.5	4,637.1	2,930.1
	(63%)	(48%)	(35%)	(70%)	(58%)	(50%)	(48%)	(38%)	(27%)
Total Dedicated Supply	94.5	82.5	64.8	23,583.3	23,061.1	19,032.0	11,625.1	12,265.2	10,707.1

Source: DWR and Reclamation 2006

Notes:

^a Percentage of normal precipitation. Water year 1998 was classified as a wet water year; 2000 was an above-normal water year; 2001 was a dry water year.

^b Environmental water includes instream flows, wild and scenic flows, required Delta outflow, and managed wetlands water use. Some environmental water is reused by agricultural and urban water users.

Key:

MAF = million acre-feet

TAF = thousand acre-feet

Outside of the fast-growing population centers, most of the CVP service area is rural, with irrigated agriculture being the predominant land use and driver of the local and regional economies (Reclamation 2007). As California's population continues to grow at a notable pace, water and power supplies have become more scarce and expensive; as a result, existing supplies have become more valuable.

Through contracts with 29 water agencies, the SWP provides water in the Central Valley to Butte, Solano, Kings, and Kern counties; to several Southern California counties; to Alameda and Santa Clara counties in the south San Francisco Bay Area; and to Napa and Solano counties in the north San Francisco Bay Area. In addition, the SWP provides water rights deliveries to water rights holders along the Feather River (Butte and Plumas counties). Of the total water delivered throughout California, the SWP provides water to about 600,000 acres of farmland. Within the extended study area, the SWP supplies about 10 percent of the total agricultural water used (DWR 2011).

Local surface water supplies (those not delivered by either the CVP or SWP) provide about 40 percent of all agricultural water in the extended study area. More local surface water supplies are available on the east side of the valley because of the larger amount of precipitation in the Sierra Nevada. Locally owned water projects are especially important on the Yuba, Stanislaus, Tuolumne, Kings, and Merced rivers; but local sources on the west side, such as the Federal Solano Project, also are important.

As surface water flows through the San Joaquin Valley, numerous turnouts convey the water to farmland within the service areas of the SWP and CVP. The remaining water conveyed by the California Aqueduct is delivered to Southern California, home to about two-thirds of California's population (DWR 2011).

Groundwater provides an important supply of water for agriculture in normal years and often is used to reduce or eliminate shortages of surface water supplies during drought years. On average, groundwater provides about 20 percent of the total agricultural water use in the extended study area. Declining groundwater tables, subsidence, and loss of aquifer storage continue to be costly problems, particularly in the western and southern parts of the San Joaquin River region and the San Francisco Bay region, where less surface water is available.

10.1.2 Important Farmland

Important Farmland is classified by California Department of Conservation (DOC) as Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance (see Section 10.2, "Regulatory Framework," for further discussion). In 2006, DOC estimated that California had approximately 30.8 million acres of agricultural land, of which approximately 12.4 million acres were identified as Important Farmland (DOC 2008a). Prime Farmland, and Important Farmland as a whole, decreased by

record amounts during the 2004 to 2006 period. Fewer new acres were brought into production to offset losses, resulting in a net decrease of 156,650 acres in irrigated farmland. The decrease in Prime Farmland (125,495 acres) was the largest documented in a 2-year update since the inception of DOC's Farmland Mapping and Monitoring Program. Figure 10-1 provides an overview of the distribution of Important Farmland in California, including the extended study area, as classified by DOC's Division of Land Resource Protection in 2008. The vast majority of the Important Farmland is located in the Central Valley, fed by the Sacramento and San Joaquin rivers and their tributaries (DOC 2008a).

Shasta Lake and Vicinity

According to the Shasta County Important Farmland map, published by DOC's Division of Land Resource Protection, there are no lands designated as Important Farmland adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam (Figure 10-1).

Upper Sacramento River (Shasta Dam to Red Bluff)

The majority of Important Farmland in the primary study area is clustered in the former floodplain of the Sacramento River. As of 2006, Shasta County had 25,727 acres and Tehama County had 231,513 acres of Important Farmland (Table 10-2). Reading Island and the potential gravel augmentation sites are not located in Important Farmland.

Table 10-2. Acreage of Important Farmland in Shasta and Tehama Counties

Important Farmland Category	Shasta County	Tehama County	Total
Prime Farmland	13,282	63,707	76,989
Farmland of Statewide Importance	3,444	17,284	20,728
Unique Farmland	488	18,085	18,573
Farmland of Local Importance	8,513	132,437	140,950
Total	25,727	231,513	257,240

Sources: DOC 2008a, 2008b

Most of the Important Farmland in the primary study area is clustered in the former Sacramento River floodplain. According to the Important Farmland maps for Shasta and Tehama counties, the primary study area includes 459 acres of Important Farmland. Of this total, 115 acres are located in Shasta County and 344 acres are located in Tehama County (Table 10-3).

Table 10-3. Acreage of Important Farmland in Portions of Shasta and Tehama Counties Within the Primary Study Area

Important Farmland Category	Shasta County	Tehama County	Total
Prime Farmland	81	44	125
Farmland of Statewide Importance	9	—	9
Unique Farmland	17	41	58
Farmland of Local Importance	8	259	267
Total	115	344	459

Source: DOC 2008a

Lower Sacramento River and Delta

During the 2006 mapping cycle, urban land uses statewide increased by 102,010 acres. Housing was the largest component of new urban acreage in the lower Sacramento River portion of the extended study area; most of the increase was associated with single-family homes located at the periphery of existing cities. Retail and commercial developments and community infrastructure supporting new residential development also contributed substantially to urbanization. Overall, the Sacramento Valley accounted for 18 percent of the net decrease in irrigated farmland.

Other factors besides conversion to urban or other land uses (e.g., habitat restoration) also affect the acreage of irrigated farmland. Regionally, complex factors related to availability of surface and groundwater supplies, crop markets, and anticipation of urban development affect the acreage of irrigated farmland. More locally, changes in annual water supplies, drainage, access, and compatibility with adjacent land uses also affect the productivity and value, and thus use, of agricultural land. Potential conflicts of adjacent land uses with agricultural production include traffic, vandalism, dumping, and provision of habitat for pest organisms (EDAW 2006; Sokolow et al. 2010).

The periphery of the Delta is undergoing rapid urbanization associated with substantial population growth. Current and future population growth will increase the demand for developable land, particularly near the Bay Area, Stockton, and Sacramento. This demand results in the conversion of open space, primarily agricultural land, to residential and commercial uses. In the recent past, thousands of acres of agricultural lands were developed for residential and other urban uses. Between 2000 and 2006, about 75,000 acres of agricultural land were converted to urban and conservation uses in the Delta. Approximately 505,300 acres of Important Farmland were located in the Delta as of 2006 (CVFMPP and FloodSAFE 2010; DOC 2008a).

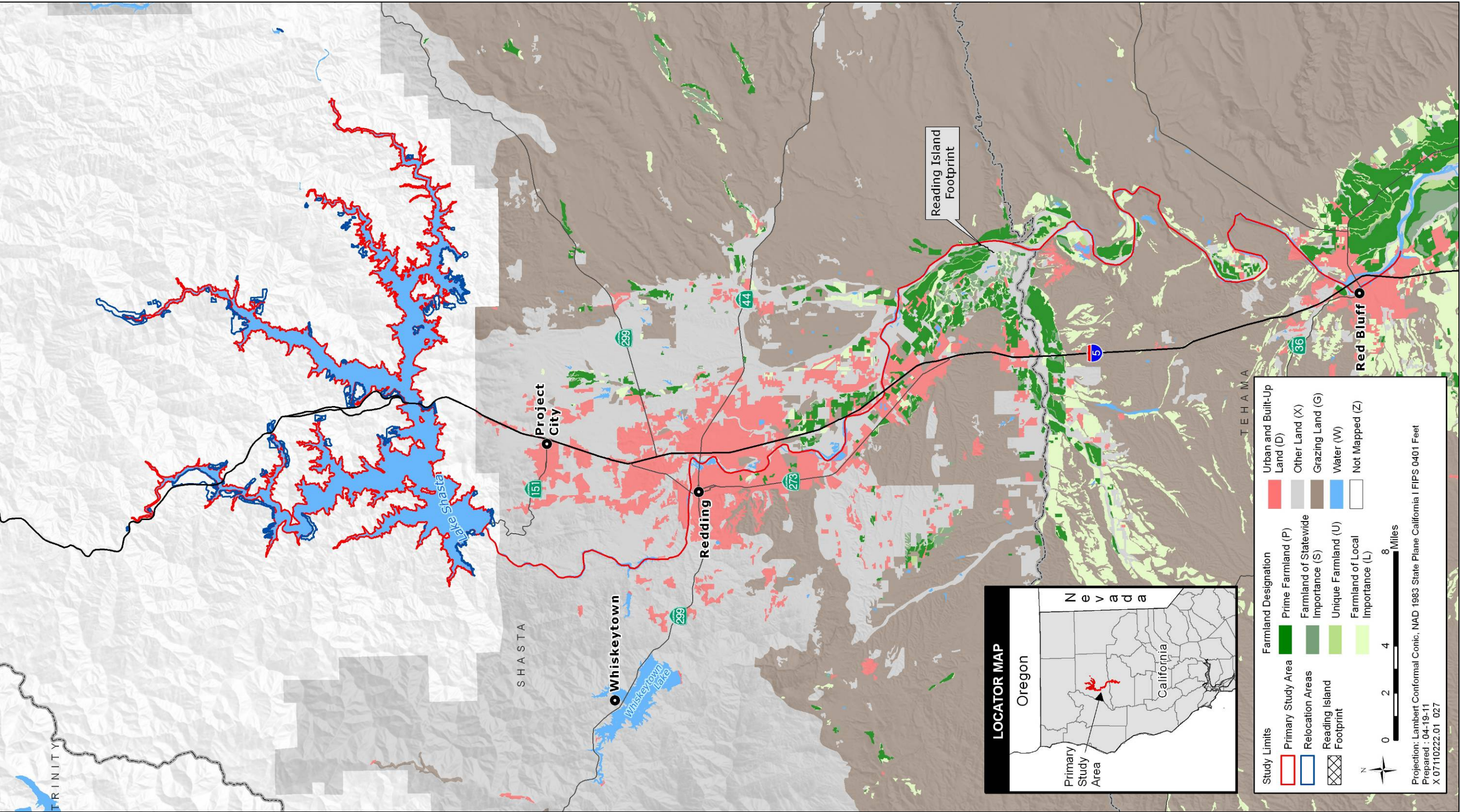


Figure 10-1. Important Farmland in the Primary Study Area

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CVP/SWP Service Areas

Declines in Important Farmland in the CVP/SWP service areas are similar to those discussed above for the lower Sacramento River and Delta. Urbanization has been responsible for 74 percent of Important Farmland and grazing land losses in the CVP/SWP service areas as a whole. As stated previously, urban land expanded by 102,010 acres during the 2006 mapping cycle. Riverside County alone accounted for 23 percent of the newly developed land. Southern California led all regions with 47 percent of the developed acres, while the San Joaquin Valley ranked second at 23 percent of the total. The Sacramento metropolitan area was third most active with 16 percent of new urban acres; Sacramento County's expansion of nearly 10,000 acres was a record high (DOC 2008a).

10.1.3 Williamson Act

As of January 1, 2007, 16.6 million acres were enrolled under the Williamson Act statewide. (Figure 10-2 shows Williamson Act lands in the primary study area.) This represents approximately half of California's farmland and nearly one-third of its privately owned land. The nonrenewal process is the most common mechanism for terminating Williamson Act contracts. Nonrenewal trends may be seen as an indicator of likely farmland conversion in particular locations. Statewide, nonrenewal initiations have increased each year since 2001 and reached a new high in 2007, with the San Joaquin Valley accounting for the largest increase in nonrenewal initiations. Overall, a total of 535,400 acres of contracted land was at some stage of the nonrenewal process in 2007 (DOC 2009a, 2009b).

10.1.4 Forest Land

Forest land is defined as native tree cover greater than 10 percent that allows for management of timber, aesthetics, fish and wildlife, recreation, and other public benefits (Public Resources Code (PRC) Section 12220(g)). Natural forest and woodland vegetation types in the study area typically have greater than 10 percent cover by native trees. (Figures 12-2a through 12-2f in Chapter 12, "Botanical Resources and Wetlands," display the distribution of natural forest and woodland vegetation.)

Forests serve as high-quality habitat for fish and wildlife species, sequester carbon to mitigate climate change, capture vital runoff for agricultural and domestic water supply, and provide a variety of outdoor recreation and education opportunities. Many rural communities depend on income and employment opportunities that result from working timber industries or on amenity values to attract new residents seeking a better lifestyle. In metropolitan areas, urban forests contribute to improved air quality, cooling of heat islands for energy conservation, and local employment (CDF 2010).

Shasta Lake and Vicinity

The study area for forest resources in the Shasta Lake and vicinity portion of the primary study area corresponds to the area that would be subject to inundation under the five action alternatives and areas where infrastructure would be removed, modified, or relocated.

The Shasta Lake and vicinity area is characterized by a variety of forest lands typical of transitional mixed woodland and low-elevation forests. Forest land within the Shasta Lake and vicinity portion of the primary study area includes blue oak woodland, Brewer's oak, California black oak forest, canyon live oak forest, Fremont cottonwood forest, ghost pine woodland, interior live oak woodland, knobcone pine forest, Oregon white oak woodland, ponderosa pine–Douglas fir forest, ponderosa pine forest, and valley oak woodland (see Figures 12-2a through 12-2f and Table 12-1 in Chapter 12, “Botanical Resources and Wetlands”). The inundation area and relocation areas (which could potentially be affected by the alternatives) contain approximately 4,669 acres of forest land and acres of forest land (Tables 10-1 and 10-2).

Table 10-4. Summary of Forest Land in the Impoundment and Relocation Areas

Forest Land	Area (Acres)
Blue oak woodland	12
Brewer oak scrub	79
California black oak forest	662
Canyon live oak forest	420
Fremont cottonwood forest	<1
Ghost pine woodland	463
Interior live oak woodland	9
Knobcone pine forest	313
Oregon white oak woodland	8
Ponderosa pine–Douglas fir forest	507
Ponderosa pine forest	2,194
Valley oak woodland	1
Total	4,669

Source: Data compiled by AECOM in 2011

The exact combination of vegetation varies, with dramatic changes often occurring in relation to aspect, slope, geologic substrate, or juxtaposition with other habitats.

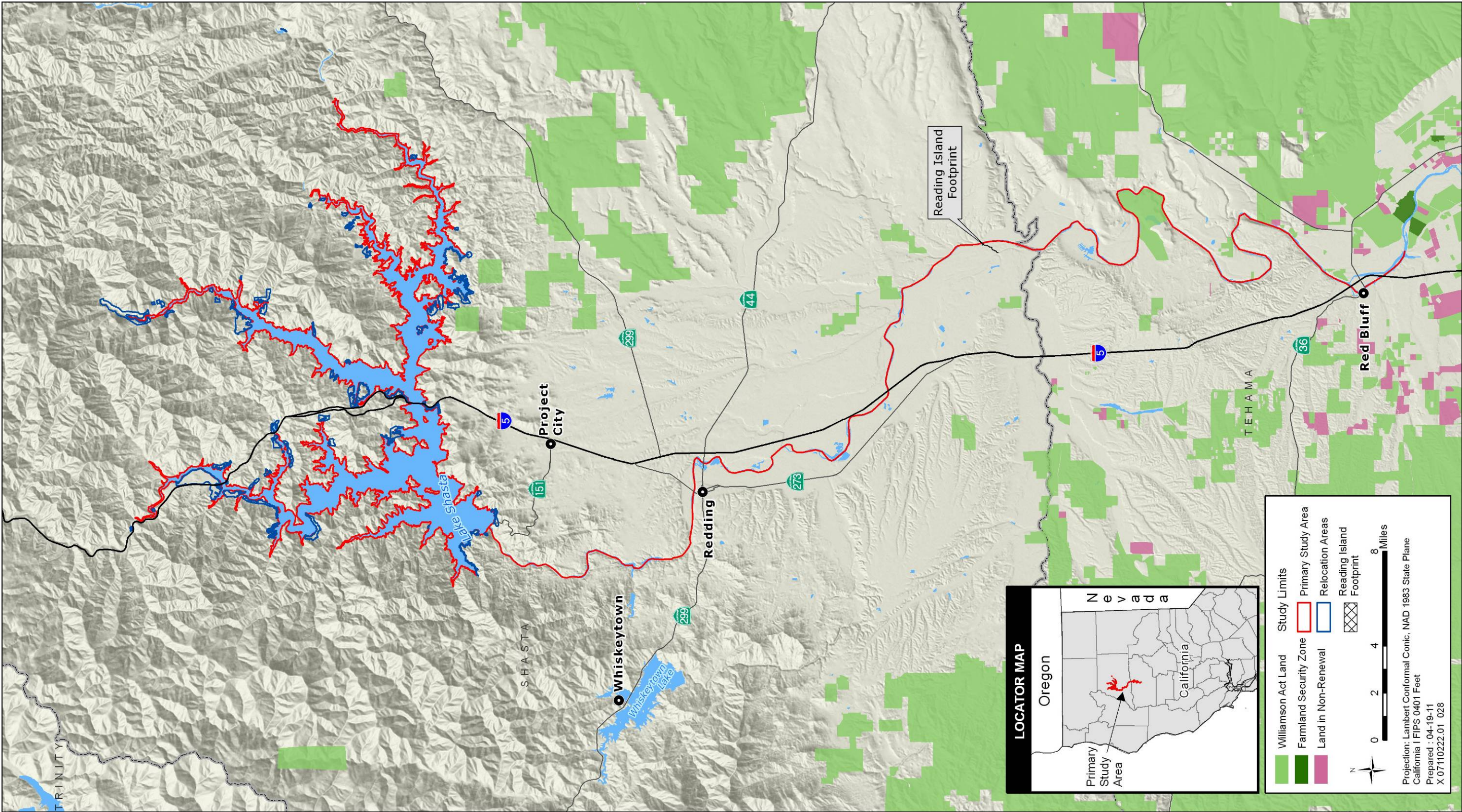


Figure 10-2. Williamson Act Lands in the Primary Study Area

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Upper Sacramento River (Shasta Dam to Red Bluff)

Forest land in the upper Sacramento River area from Shasta Dam to Red Bluff consists of riparian forest and oak woodland and savanna. Oak woodlands present in the primary study area include blue oak woodland, blue oak savanna, foothill pine-oak woodland, and valley oak woodland. Much of the Sacramento River from Shasta Dam to Redding is deeply entrenched in bedrock, which precludes development of extensive areas of riparian vegetation. The river corridor between Redding and Red Bluff, however, still maintains extensive areas of riparian forest communities.

Riparian plant communities present within the primary study area are located within the floodplain of the Sacramento River. These communities include Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, and Great Valley valley oak riparian forest. Cottonwood- and willow-dominated riparian forest and woodland are present along active channels and on the lower flood terraces, whereas valley oak-dominated communities occur on higher flood terraces. In general, only narrow remnants of these riparian forests remain, often because levees are located close to river channels and the remaining riparian forest habitat is confined primarily to levee slopes. Riparian vegetation exists at Reading Island and some of the potential gravel augmentation sites.

Lower Sacramento River and Delta

Almost all of this forest land in the lower Sacramento River and Delta consists of riparian forests, including cottonwood-willow woodland and Valley oak riparian woodland. These areas are typically found in the lower Sacramento River and Delta as long, linear patches bordering waterways and agricultural or urban land. Riparian vegetation is most extensive on the water side of levees, but patches of riparian vegetation are also found on the interior of Delta islands along levee toes; along drainage channels; along pond margins; and in abandoned, low-lying fields. Forest land in riparian areas is managed primarily for habitat and water quality values, and to a lesser extent for recreation and other public benefits.

CVP/SWP Service Areas

Forest resources in the CVP and SWP service areas are similar to those discussed above for the upper Sacramento River (Shasta Dam to Red Bluff) and the lower Sacramento River and Delta. Agricultural and urban land uses have substantially reduced the area and connectivity of forest land in the CVP and SWP service areas. Substantial changes to the natural landscape in the region occurred in the late 1800s and early 1900s with land conversions to agriculture. In southern California, however, that pattern shifted dramatically compared to the pattern in the Central Valley, as urban growth in the region that started in the 1900s began to convert large areas of forest land to developed land uses.

10.2 Regulatory Framework

10.2.1 Federal

Farmland Protection Policy Act

The Farmland Protection Policy Act is intended to minimize the effect of Federal programs with respect to the conversion of farmland to nonagricultural uses. It ensures that, to the extent possible, Federal programs are administered to be compatible with State, local, and private programs and policies to protect farmland. The U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) is the agency primarily responsible for implementing the Farmland Protection Policy Act.

The Farmland Protection Policy Act established the Farmland Protection Program and the Land Evaluation and Site Assessment system. NRCS administers the Farmland Protection Program, which is a voluntary program that provides funds to help purchase development rights to keep productive farmland in agricultural uses. The program provides matching funds to State, local, and tribal entities and nongovernmental organizations with existing farmland protection programs to purchase conservation easements. Participating landowners agree not to convert the land to nonagricultural uses and retain all rights to the property for future agriculture. A minimum 30-year term is required for conservation easements, and priority is given to applications with perpetual easements. NRCS provides up to 50 percent of the fair market value of the easement (NRCS 2006).

The Land Evaluation and Site Assessment system is a tool used to rank lands for suitability and inclusion in the Farmland Protection Program. The Land Evaluation and Site Assessment evaluates several factors: soil potential for agriculture, climate, location, market access, and adjacent land use. These factors are used to numerically rank land parcels based on local resource evaluation and site considerations (NRCS 2006).

10.2.2 State

California Important Farmland Inventory System and Farmland Mapping and Monitoring Program

The DOC Office of Land Conservation maintains a statewide inventory of farmlands. These lands are mapped by the Division of Land Resource Protection as part of the Farmland Mapping and Monitoring Program. The Farmland Mapping and Monitoring Program was established by the State of California in 1982 to continue the Important Farmland mapping efforts begun in 1975 by the U.S. Soil Conservation Service (now called NRCS). The intent of the U.S. Soil Conservation Service was to produce agricultural-resource maps based on soil quality and land use across the nation. DOC sponsors the Farmland Mapping and Monitoring Program and is also responsible for establishing agricultural easements in accordance with PRC Sections 10250-

10255. The maps are updated every 2 years with the use of aerial photographs, a computer mapping system, public review, and field reconnaissance.

As part of the nationwide agricultural-land-use mapping effort, U.S. Soil Conservation Service/NRCS developed a series of definitions known as Land Inventory and Monitoring criteria. The Land Inventory and Monitoring criteria classify the land's suitability for agricultural production. Suitability includes both the physical and chemical characteristics of soils and the actual land use. Important Farmland maps are derived from NRCS soil survey maps using the Land Inventory and Monitoring criteria and are available by county. The maps prepared by NRCS classify land into one of eight categories, which are defined as follows (DOC 2008a):

- **Prime Farmland** – land that has the best combination of physical and chemical characteristics for crop production. It has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops when treated and managed.
- **Farmland of Statewide Importance** – land of importance to the local economy, as defined by each county's local advisory committee and adopted by its board of supervisors. Farmland of Local Importance is land other than Prime Farmland that has a good combination of physical and chemical characteristics for crop production. This land has minor shortcomings, such as greater slopes or less ability to store soil moisture than Prime Farmland.
- **Unique Farmland** – land that does not meet the criteria for Prime Farmland or Farmland of Statewide Importance, but that has been used for the production of specific crops with high economic value. This land is usually irrigated, but may include nonirrigated orchards or vineyards as found in some climatic zones in California.
- **Farmland of Local Importance** – land that is either currently producing crops or has the capability of production, but does not meet the criteria of the categories above.
- **Grazing Land** – land on which the vegetation is suited to the grazing of livestock. The minimum mapping unit for Grazing Land is 40 acres.
- **Urban and Built-up Lands** – land occupied by structures with a density of at least one dwelling unit per 1.5 acres.
- **Land Committed to Nonagricultural Use** – vacant areas; existing lands that have a permanent commitment to development but have an existing land use of agricultural or grazing lands.

- **Other Lands** – Land that does not meet the criteria of the remaining categories. This optional designation allows local governments to provide detail on the nature of changes expected to occur in the future.

Important Farmland is classified by DOC as Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance. The total acreages of Urban and Built-up Lands and Other Lands are calculated by DOC and are defined by DOC as agricultural land.

The designations for Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance are defined together under the terms “Agricultural Land” and “Important Farmland” in CEQA (PRC Sections 21060.1 and 21095 and State CEQA Guidelines Appendix G). The conversion of these types of farmland could be considered an environmental impact.

Williamson Act Contracts

The California Land Conservation Act of 1965, commonly known as the Williamson Act, is the principal method for encouraging the preservation of agricultural lands in California. The Williamson Act enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open-space use for 10 years. In return, landowners receive property tax assessments that are based on farming and open-space uses as opposed to full market value. Local governments receive an annual subvention (subsidy) of forgone property tax revenues from the State via the Open Space Subvention Act of 1971.

The Williamson Act empowers local governments to establish “agricultural preserves” consisting of lands devoted to agricultural uses and other uses that are compatible with agriculture. Upon establishment of such preserves, the locality may offer to owners of included agricultural land the opportunity to enter into annually renewable contracts that restrict the land to agricultural use for at least 10 years (i.e., the contract continues to run for 10 years after the first date upon which the contract is not renewed). In return, the landowner is guaranteed a relatively stable tax base, founded on the value of the land for agricultural/open space use only and unaffected by its development potential.

Canceling a Williamson Act contract involves an extensive review and approval process, in addition to payment of fees of up to 12.5 percent of the property value. The local jurisdiction approving the cancellation must find that the cancellation is consistent with the purpose of the California Land Conservation Act or is in the public interest. Several subfindings must be made to support either finding, as defined in California Government Code Section 51282.

Farmland Security Zones

Farmland Security Zones (FSZ), also known as Super Williamson Act lands, were established by DOC with the same general intent as Williamson Act

contracts. An FSZ must be located in an agricultural preserve (area designated as eligible for a Williamson Act contract). Agricultural landowners in FSZs may enter into contracts with the county for 20-year increments, with an additional 35 percent tax benefit over and above the standard Williamson Act contract. The FSZ program has been adopted by 25 counties, although not all of those counties have executed contracts.

An FSZ must be located in an Agricultural Preserve (area designated as eligible for a Williamson Act contract) and designated as Prime Farmland, Farmland of Statewide Importance, Unique Farmland, or Farmland of Local Importance. Land protected in an FSZ cannot be annexed by a city or county government or school district. FSZ contracts constitute nearly 2 percent of statewide Williamson Act enrollment.

An FSZ can be terminated through a nonrenewal or cancellation. The nonrenewal allows a rollout process to occur over the remainder of the term of the contract, when the tax rates would gradually rise to the full rate by the end of the 20-year term. A cancellation must be applied for and approved by the director of the DOC, and specific criteria must be met. The cancellation must be in the public interest and consistent with Williamson Act criteria. If a cancellation is approved, fees equal to 25 percent of the full market value of the property must be paid.

Agricultural Water Management Plans

By the end of 2004, 62 water districts, three environmental interest groups, and more than 53 other interested groups had signed the Agricultural Water Management Memorandum of Understanding as members of the Agricultural Water Management Council. The agricultural signatories represent more than 4.75 million acres of irrigated agricultural land statewide.

In 2004, the council endorsed an additional three agricultural water management plans that had been submitted by agricultural water suppliers to the council. Subsequently, these plans have become the basis for the districts' water conservation efforts. The districts with endorsed agricultural water management plans are expected to prepare and submit a biannual progress report to the Agricultural Water Management Council, starting from the date their plan was endorsed. DWR staff members provide technical review and evaluation of these plans. DWR also reviewed two biannual progress reports for the council. DWR staff also provided technical assistance to water districts to prepare water management plans and helped implement efficient water management practices, as well as administrative and programmatic assistance to both the Agricultural Water Management Council and water districts.

1992 Delta Protection Act

The 1992 Delta Protection Act identified the Delta as a natural resource of statewide significance, formalized the State's commitment to preserve its diverse values, and established the Delta Protection Commission. The purpose

of the Delta Protection Act is to ensure protection, maintenance, and enhancement of the Delta environment; ensure orderly and balanced use of Delta land resources; and improve flood protection to increase public health and safety. The Delta Protection Commission has planning jurisdiction over portions of five counties: Contra Costa, Sacramento, San Joaquin, Solano, and Yolo.

In Section 29703a of the Delta Protection Act, the Delta Primary Zone is designated as an area for protection from intrusion of nonagricultural uses. In 1995, the Delta Protection Commission adopted its regional plan, *Land Use and Resource Management Plan for the Primary Zone of the Delta* (also known as the Delta Plan). The current Delta Plan was approved by the California Office of Administrative Law on October 7, 2010, and became effective November 6, 2010. Policies in the Delta Plan are developed to project the conversion of agricultural resources. Policy P-2 states that conversion of land to non-agriculturally oriented uses should occur first where productivity and agricultural values are lowest. Policy P-6 encourages acquiring agricultural conservation easements from willing sellers as mitigation for projects within each county. Use of environmental mitigation is to be promoted in agricultural areas only when it is consistent and compatible with ongoing agricultural operations and when developed in appropriate locations designated on a countywide or Deltawide habitat management plan (DPC 2010).

10.2.3 Regional and Local

Shasta and Tehama Counties

The general plans of Shasta and Tehama counties contain goals, policies, and implementation measures to protect agricultural lands, as summarized below.

Shasta County General Plan The *Shasta County General Plan* (Shasta County 2004) identifies goals, policies, and implementation measures aimed at conserving large contiguous areas of productive agricultural land, providing opportunities for the future expansion of such uses, and protecting them from development pressures that would adversely affect or hinder existing or future agricultural operations. This includes the objective to protect water resources and supply systems vital for the continuation of agriculture.

Tehama County General Plan The *Tehama County General Plan* (2009) encourages and supports agriculture and forest resources in Tehama County. The policies are within the Agriculture and Timber Element of the general plan and divided into the Land Use, Open Space and Conservation, and Economic Development Elements to aid in implementation of the general plan, but focus on agriculture nonetheless.

Other

Sacramento River Conservation Area The Sacramento River Conservation Area seeks to promote the reestablishment of the 100-year floodplain along the Sacramento River. In 1986, the California Legislature passed Senate Bill 1086,

which called for a management plan for the Sacramento River that would help restore, protect, and enhance the riparian and aquatic habitat. After much debate, the *Upper Sacramento River Fisheries and Riparian Habitat Management Plan* was developed (Resources Agency 1989). This plan called for fish bypass structures on the Sacramento River and its tributaries, as well as the Shasta Dam temperature control structure. After implementation of these projects began, the advisory council reconvened to complete additional work. This effort led to the *Sacramento River Conservation Area Handbook* (Resources Agency 2003), which would guide riparian habitat management along the river. In 1999, a memorandum of agreement was signed by most entities involved in management activities along the river. The U.S. Bureau of Land Management has acquired roughly 15,000 acres of riparian lands along the Sacramento River.

10.3 Environmental Consequences and Mitigation Measures

10.3.1 Methods and Assumptions

Implementation of the project would result in construction, maintenance, and operational impacts that could substantially affect agricultural and forest resources. This analysis evaluates potential construction and operational activities that could directly or indirectly affect existing agricultural and forest resources in the primary study area. Indirect impacts on the extended study area could result from alteration of flow regimes downstream from Shasta Lake and downstream from other reservoirs with altered operations, as well as increased inundation width of the Sacramento River during the growing season. In addition, water supply reliability in the CVP and SWP service areas could increase, which could in turn reduce limitations on growth and increase development that could adversely affect agricultural and forest resources.

Evaluation of the project's potential impacts on agricultural resources was based on a review of the planning documents pertaining to the project areas, including goals and policies from the general plans of Shasta and Tehama counties. DOC's Important Farmland and Williamson Act maps were used to determine the agricultural significance of the lands in the primary study area. In addition, the results of CalSim-II simulations were reviewed to assess changes in flow regime in the primary and extended study areas.

Forest land that could be inundated or affected by the alternatives was determined from vegetation mapping as described in Chapter 12, "Botanical Resources and Wetlands." These forest lands include blue oak–foothill pine, blue oak, and closed-cone pine-cypress woodlands; and Douglas-fir, montane hardwood, montane hardwood-conifer, montane riparian, Ponderosa pine, and valley-foothill riparian forests. The following analysis summarizes information provided in Chapter 12, "Botanical Resources and Wetlands" as it relates to the potential conversion of forest land to nonforest uses.

10.3.2 Criteria for Determining Significance of Effects

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental effects that would be caused by, or result from, the proposed action. Under NEPA, the significance of an effect is used solely to determine whether an environmental impact statement must be prepared. An environmental document prepared to comply with CEQA must identify the potentially significant environmental effects of a proposed project. A “[s]ignificant effect on the environment” means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project” (State CEQA Guidelines, Section 15382). CEQA also requires that the environmental document propose feasible measures to avoid or substantially reduce significant environmental effects (State CEQA Guidelines, Section 15126.4(a)).

The following significance criteria were developed based on guidance provided by the State CEQA Guidelines, and consider the context and intensity of the environmental effects as required under NEPA. Impacts of an alternative on agriculture and Important Farmland would be significant if project implementation would do any of the following:

- Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to nonagricultural use
- Conflict with existing zoning for agricultural use, or a Williamson Act contract
- Conflict with existing zoning for, or cause rezoning of, forest land (as defined in PRC Section 12220(g)), timberland (as defined in PRC Section 4526), or timberland zoned Timberland Production (as defined in PRC Section 51104(g))
- Result in the loss of forest land or conversion of forest land to nonforest use
- Involve other changes in the existing environment that, because of their location or nature, could result in conversion of farmland, to nonagricultural use or the conversion of forest land to nonforest use

10.3.3 Topics Eliminated from Further Consideration

None of the lands in the primary study area are zoned as forest land, timberland, or timberland zoned Timberland Production by the *Shasta County General Plan* (2004) or *Tehama County General Plan* (2009). Increasing water supply reliability within the lower Sacramento River to the Delta and within the CVP and SWP service areas would not conflict with existing zoning or directly result in the rezoning of forest land, timberland, or timberland zoned Timberland

Production. Therefore, no effects related to conflicts with existing zoning or causing rezoning of forest land are expected to occur in the study area; therefore, potential effects related to this issue area are not discussed further in this PDEIS.

10.3.4 Direct and Indirect Effects

No-Action Alternative

Under the No-Action Alternative, the existing Shasta Dam would be operated in the same manner as under current operations. Shasta Dam would not be enlarged and no infrastructure would be removed, modified, or relocated. Changes to the reservoir flow regime caused by changes in demand and other factors would be small, with a reduction in Shasta Lake storage of 2–4 percent during the fall of some years. Shasta Lake storage under the No-Action Alternative would be within -2 percent and 1 percent of Shasta Lake storage under existing conditions at most times.

Under the No-Action Alternative, changes to the flow regime of the upper Sacramento River as a result of changes in demand and other factors would be small; mean monthly flows in the Sacramento River would be within 5 percent of flows under existing conditions at most times. (Flows could increase by a greater amount during late summer and early fall of below-normal, dry, and critical years.)

Under the No-Action Alternative, the flow regime in the lower Sacramento River and Delta would not change as a result of Shasta Lake operations. It is anticipated that if the project alternatives were not implemented, CVP and SWP operations would continue under existing regulatory requirements. CVP and SWP water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlarging Shasta Dam. Overall, CalSim-II modeling results suggest that there would be only a very small decrease in flows greater than 15,000 cubic feet per second.

Shasta Lake and Vicinity

Impact Ag-1 (No-Action): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake No new facilities would be constructed at Shasta Lake and no operational changes would occur that would directly convert Important Farmland to nonagricultural uses or result in the cancellation of Williamson Act contracts in the vicinity of Shasta Lake. However, California's demand for water for irrigation and other uses is expected to continue to increase while the water supply will likely become less reliable. This trend could lead to increased pressure to convert Important Farmland to other nonagricultural uses and cancel Williamson Act contracts, resulting in an indirect impact. Therefore, this impact would be potentially significant.

Under the No-Action Alternative, Shasta Dam would not be enlarged; no infrastructure would be removed, modified, or relocated; and no changes in Reclamation's Shasta operations would occur. Changes to reservoir flow regime and reservoir storage caused by changes in demand and other factors would be small, and generally the same as under existing conditions at most times. Therefore, implementing the No-Action Alternative would not directly convert agricultural land to nonagricultural uses or result in the cancellation of Williamson Act contracts.

The demand for water for irrigation and other uses in California is expected to continue to increase in the future; at the same time, the water supply may become less reliable because of increasing environmental water requirements for special-status species, decreasing water quality, and climate change. Therefore, the No-Action Alternative could have an indirect, adverse impact on agricultural land uses and Important Farmland in the primary study area. Insufficient water supply, especially during drought periods, could indirectly lead to increased pressure on farmers to convert Important Farmland to other nonagricultural uses, or could cause land designated as Important Farmland to be fallowed. Additionally, the conversion of Important Farmland could also involve cancellation or expiration of many Williamson Act contracts.

The magnitude and extent of the agricultural land that could be converted from changes in water supply is unknown; however, any loss of Important Farmland would be significant because there are no measures to fully mitigate the loss of Important Farmland. Based on a review of future demand projections used in CalSim-II modeling and estimated deliveries under the No-Action Alternative, this impact would be potentially significant. Mitigation is not required for the No-Action Alternative.

Impact Ag-2 (No-Action): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake No new facilities would be constructed at Shasta Lake and no operational changes would occur that would result in the direct or indirect conversion of forest land to nonforest uses. No impact would occur.

Under the No-Action Alternative, Shasta Dam would not be enlarged; no infrastructure would be removed, modified, or relocated; and no changes in Reclamation's Shasta operations would occur. Changes to reservoir flow regime and reservoir storage caused by changes in demand and other factors would be small and generally the same as under existing conditions at most times. Therefore, the No-Action Alternative would not result in the direct or indirect conversion to nonforest uses of blue oak–foothill pine, blue oak, and closed-cone pine-cypress woodlands; Douglas-fir, montane hardwood, montane hardwood-conifer, montane riparian, Ponderosa pine, and valley-foothill riparian forests; or other forest land. No impact would occur. Mitigation is not required for the No-Action Alternative.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Ag-3 (No-Action): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River Under the No-Action

Alternative, changes to the flow regime of the upper Sacramento River resulting from changes in demand and other factors would be small; mean monthly flows in the Sacramento River would be within 5 percent of flows under existing conditions at most times. Implementing the No-Action Alternative would not directly convert Important Farmland to nonagricultural uses or result in the cancellation of Williamson Act contracts in the upper Sacramento River region (Shasta Dam to Red Bluff). However, California's demand for water for irrigation and other uses is expected to continue to increase while the water supply will likely become less reliable. This trend could lead to increased pressure to convert Important Farmland to other nonagricultural uses and cancel Williamson Act contracts, resulting in an indirect impact. Therefore, this impact would be potentially significant.

Under the No-Action Alternative, changes to the flow regime of the upper Sacramento River resulting from changes in demand and other factors would be small; mean monthly flows in the Sacramento River would be within 5 percent of flows under existing conditions at most times. Therefore, implementing the No-Action Alternative would not directly convert agricultural land to nonagricultural uses or result in the cancellation of Williamson Act contracts.

California's demand for water for irrigation and other uses is expected to continue to increase in the future; at the same time, the water supply may become less reliable because of increasing environmental water requirements for special-status species, population growth that place further demands on existing water supply resources, decreasing water quality, and climate change. Therefore, the No-Action Alternative could have an indirect, adverse impact on agricultural land uses and Important Farmland in the primary study area. Insufficient water supply, especially during drought periods, could indirectly lead to increased pressure on farmers to convert Important Farmland to other nonagricultural uses or cause land designated as Important Farmland to be fallowed. Additionally, conversion of Important Farmland could involve canceling many Williamson Act contracts or allowing such contracts to expire.

The magnitude and extent of the agricultural land that could be converted from changes in water supply is unknown; however, any loss of Important Farmland would be significant because there are no measures to fully mitigate the loss of Important Farmland. Based on a review of future demand projections used in CalSim-II modeling and estimated deliveries under the No-Action Alternative, this impact would be potentially significant. Mitigation is not required for the No-Action Alternative.

Impact Ag-4 (No-Action): Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River No operational changes

would occur that would directly convert forest land to nonforest uses along the upper Sacramento River. However, water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlargement of Shasta Dam. The resulting changes in flow regime would likely result in minimal adverse effects on riparian forest and oak woodland habitats. Furthermore, management and restoration plans and programs would implement actions that would largely offset those adverse effects. Therefore, this impact would be less than significant.

Under the No-Action Alternative, no changes in Reclamation's Shasta operations would occur that would directly convert riparian and oak woodland habitats along the upper Sacramento River to nonforest uses. However, water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlargement of Shasta Dam. As a consequence of these actions, the flow regime of the upper Sacramento River would change between 2005 and 2030. As described in Chapter 12, "Botanical Resources and Wetlands," this change in flow regime would likely result in minimal adverse effects on forest land, which along the upper Sacramento River consist of riparian forest and oak woodlands, and these effects would not be sufficient to alter the extent of these forest lands.

As discussed in Chapter 12, "Botanical Resources and Wetlands," under the No-Action Alternative several management and restoration plans and programs would be implemented. These actions would cause beneficial effects likely to be of a magnitude similar to or greater than the anticipated adverse effects of small changes in flow regime; thus, implementation of the plans and programs would largely offset those adverse effects. Therefore, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Ag-5 (No-Action): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Extended Study Area Under the No-Action Alternative, changes to the flow regime of the lower Sacramento River, Delta, and CVP and SWP service areas as a result of changes in demand and other factors would be small; mean monthly flows in the Sacramento River would be within 5 percent of flows under existing conditions at most times. Implementing the No-Action Alternative would not directly convert Important Farmland to nonagricultural uses or result in the cancellation of Williamson Act contracts along the lower Sacramento River, in the Delta, or in the CVP and SWP service areas. However, California's demand for water for irrigation and other uses is expected to continue to increase while the water supply will likely become less reliable. This trend could lead to increased pressure to convert Important Farmland to other nonagricultural uses and cancel Williamson Act contracts, resulting in an indirect impact. Therefore, this impact could be potentially significant.

This impact would be similar to Impact Ag-3 (No-Action) for the upper Sacramento River (Shasta Dam to Red Bluff). For the same reasons as described above for Impact Ag-3 (No-Action), this impact would be potentially significant. Mitigation is not required for the No-Action Alternative.

Impact Ag-6 (No-Action): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area No operational changes would occur under the No-Action Alternative that would directly convert forest land to nonforest uses along the upper Sacramento River. However, water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlargement of Shasta Dam. The resulting changes in flow regime would likely result in minimal adverse effects on forest land, which consists of riparian forest and oak woodlands along the lower Sacramento River and in the Delta. Management and restoration plans and programs would implement actions that would largely offset those adverse effects. Therefore, this impact would be less than significant.

This impact would be similar to Impact Ag-4 (No-Action) for the upper Sacramento River (Shasta Dam to Red Bluff). For the same reasons as described above for Impact Ag-4 (No-Action), this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

By increasing storage at Shasta Lake, this alternative would change the full pool elevation and seasonal pool elevations at Shasta Lake, and the flow regime downstream in the Sacramento River and potentially several other reservoirs and downstream waterways. The full pool elevation of Shasta Lake would increase by 8.5 feet and would periodically inundate this elevation zone. Existing facilities would be relocated from this periodically inundated zone to higher areas.

Potential impacts of CP1 on the upper Sacramento River's flow and stages and on deliveries of water supplies to the CVP and SWP service areas would be small. On average, in each month, changes in mean monthly flow relative to existing (2005) and No-Action Alternative (2030) conditions would be reductions or increases of about 5 percent or less. Generally, the relative magnitude of effects on river flows diminishes with distance downstream because of the influence of inflows from tributaries and the effects of diversions and flood bypasses.

Shasta Lake and Vicinity

Impact Ag-1 (CP1): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake No lands adjacent to Shasta Lake or in the immediate

vicinity above Shasta Dam are designated by DOC as Important Farmland or under Williamson Act contracts. No impact would occur.

No lands adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam are designated by DOC as Important Farmland or under Williamson Act contracts. Therefore, inundation of land and removal, modification, or relocation of infrastructure under CP1 would not directly or indirectly convert agricultural land to nonagricultural uses or result in the cancellation of Williamson Act contracts. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-2 (CP1): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake Inundation of land and removal, modification, or relocation of infrastructure under CP1 would result in the conversion of forest land to nonforest uses. This impact would be significant.

A total of 1,051 acres of forest land would be affected by inundation under CP1 (Table 10-5). Also, approximately 107 acres of land in the relocation areas would be affected by removal, modification, or relocation of infrastructure under CP1 (acreages were calculated based on infrastructure relocation information presented in Chapter 2, “Alternatives”); and most of this acreage would involve conversion of forest land to nonforest uses. This impact would be significant. Mitigation for this impact is not proposed because no feasible mitigation is available to reduce the impact to a less than significant level.

Table 10-5. Acreage of Forest Land that Would Be Affected by Inundation Under CP1

Forest Land	Area (Acres)
Blue oak–foothill pine	10
Blue oak woodland	1
Closed-cone pine–cypress	247
Douglas-fir	<1
Montane hardwood	187
Montane hardwood–conifer	234
Montane riparian	26
Ponderosa pine	345
Total	1,051

Source: Data compiled by AECOM in 2011

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Ag-3 (CP1): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River Within the upper Sacramento River portion of the primary study area, inundation of agricultural lands, including Important Farmland and Williamson Act contract lands, could result from increases in

mean monthly river flows. In general, the flow increases that would occur in some years would be expected to be small (5 percent or less) and would affect areas periodically inundated under existing and No-Action Alternative conditions. The effects of increased flow would diminish with distance downstream. CP1 also would increase the reliability of the water supply by increasing firm water supplies for irrigation purposes, primarily during drought periods. Therefore, implementing CP1 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

Within the upper Sacramento River portion of the primary study area, inundation or soil saturation of agricultural lands, including Important Farmland and Williamson Act contract lands, could result from increases in mean monthly river flows associated with project implementation and operation. Based on CalSim-II model simulations, the increases in flow that would occur in some years under CP1 would be expected to be small (5 percent or less) relative to existing (2005) and No-Action Alternative (2030) conditions. These increased flows would affect small areas periodically inundated under existing conditions or under the No-Action Alternative. In addition, the effects would diminish with distance downstream because of the influence of inflows from tributaries and the effects of diversions and flood bypasses. As a result, implementing CP1 would not directly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts.

CP1 would increase the reliability of the water supply by increasing firm water supplies for irrigation purposes, primarily during drought periods. A substantial portion of this water would substitute for groundwater pumping, allow for changes in agricultural irrigation practices, or return idle cropland to production. Therefore, implementing CP1 would not indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts.

For the reasons described above, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-4 (CP1): Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River Altered flow regimes associated with project implementation under CP1 could adversely affect forest land along the upper Sacramento River. The altered flow regime could affect oak woodland communities by prolonging inundation and changing the availability of soil moisture; however, these effects are speculative, and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of forests in the riparian corridor along the upper Sacramento River in the future; however, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing CP1 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

Forest land along the upper Sacramento River from Shasta Dam to Red Bluff consists of riparian forest and oak woodlands. These habitats could be affected by changes in flow and stage along the upper Sacramento River in some years. In most years, changes in mean monthly flow would be reductions or increases of 5 percent or less. The areas affected would be areas periodically inundated under existing and No-Action Alternative conditions. Generally, these effects diminish with distance downstream because of the influence of inflows from tributaries and of diversions and flood bypasses.

The altered flow regime of the upper Sacramento River associated with implementation of CP1 could affect oak woodland communities by prolonging inundation and changing the availability of soil moisture. This effect would occur during years when mean monthly stage during March–October differs from existing and No-Action Alternative conditions. Implementing CP1 could increase the average elevation of the water surface in this zone slightly (but would not increase the zone’s elevational range). Because of the important influence of water availability and soil aeration on plant growth and survival, these changes have the potential to result in the loss of oak woodlands. These effects, however, are speculative, and may not all prove to be adverse.

The flow regime of a river or stream strongly influences the structure and species composition of riparian forests. CP1 would not alter the general annual pattern of flows, but it would reduce the magnitude, duration, and frequency of intermediate and large flows. Reductions in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of forests in the riparian corridor along the upper Sacramento River; however, changes in flow regime would not reduce the extent of riparian forest.

For the reasons described above, implementing CP1 would not result in the conversion of forest land to nonforest uses. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Ag-5 (CP1): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Extended Study Area Within the extended study area, inundation or soil saturation of agricultural lands, including lands designated as Important Farmland and under Williamson Act contract, could result from increased mean monthly river flows. Increases in Sacramento River stage (elevation) would be small. These increased flows would affect areas periodically inundated or saturated under existing conditions or under the No-Action Alternative. The effects of this inundation would diminish with distance downstream. CP1 also would increase the reliability of the water supply by increasing firm water supplies for irrigation purposes, primarily during drought periods. Therefore, implementing CP1 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

Within the extended study area, inundation or soil saturation of agricultural lands, including lands designated as Important Farmland and under Williamson Act contract, could be more extensive during some months because of increased mean monthly river flows associated with project implementation and operation. However, these increased flows would affect areas periodically inundated or saturated under existing conditions and/or the No-Action Alternative. In addition, the effects of inundation would diminish with distance downstream because of the influence of inflows from tributaries and the effect of diversions and flood bypasses. As a result, the direct conversion of agricultural land to nonagricultural uses or cancellation of Williamson Act contracts is unlikely to be substantial.

CP1 would increase the reliability of the water supply by increasing firm water supplies for irrigation purposes, primarily during drought periods. A substantial portion of this water would substitute for groundwater pumping, allow for changes in agricultural irrigation practices, or return idle cropland to production. Therefore, implementing CP1 would not indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts.

For the reasons described above, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-6 (CP1): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area Altered flow regimes associated with project implementation under CP1 could adversely affect riparian forest and oak woodlands. The altered flow regime could affect oak woodlands by prolonging inundation and changing soil moisture in some years; however, these effects are speculative, and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian forests along the upper Sacramento River in the future; however, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing CP1 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-4 (CP1) for the upper Sacramento River (Shasta Dam to Red Bluff). For the same reasons as described above for Impact Ag-4 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

Like CP1, by increasing storage at Shasta Lake, CP2 would change the reservoir's full pool elevation and seasonal pool elevations, and the flow regime in the Sacramento River and potentially several other reservoirs and downstream waterways.

The full pool elevation of Shasta Lake would increase by 14.5 feet and the pool elevation would average as much as 12–17 feet higher than under existing (2005) and No-Action Alternative (2030) conditions at various times of the year. The greatest change would occur during the wettest years. Raising the dam 12.5 feet would increase the reservoir's surface area at full pool by about 1,750 acres (6 percent). In general, the effect of this increase would be slight, given that the reservoir would exceed the current full pool elevation only during wetter-than-normal years.

In general, the proposed changes in flow and river stage on the upper Sacramento River associated with CP2 are similar to but slightly greater than the changes associated with CP1, as outlined above.

Shasta Lake and Vicinity

Impact Ag-1 (CP2): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake No lands adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam are designated by DOC as Important Farmland or under Williamson Act contracts. No impact would occur.

This impact would be the same as Impact Ag-1 (CP1). No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-2 (CP2): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake Inundation of land and removal, modification, or relocation of infrastructure under CP2 would result in the conversion of forest land to nonforest uses. This impact would be significant.

A total of 1,440 acres of forest land would be affected by inundation under CP2 (Table 10-6). Also, approximately 116 acres of land in the relocation areas would be affected by removal, modification, or relocation of infrastructure under CP2 (acreages were calculated based on infrastructure relocation information presented in Chapter 2, "Alternatives"); and most of this acreage would involve conversion of forest land to nonforest uses. This impact would be significant. Mitigation for this impact is not proposed because no feasible mitigation is available to reduce the impact to a less than significant level.

Table 10-6. Acreage of Forest Land that Would Be Affected by Inundation Under CP2

Forest Land	Area (Acres)
Blue oak–foothill pine	15
Blue oak woodland	2
Closed-cone pine–cypress	343
Douglas-fir	<1
Montane hardwood	260
Montane hardwood–conifer	332
Ponderosa pine	488
Total	1,440

Source: Data compiled by AECOM in 2011

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Ag-3 (CP2): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River Within the upper Sacramento River portion of the primary study area, inundation of agricultural lands, including Important Farmland and Williamson Act contract lands, could result from increases in mean monthly river flows. In general, the flow increases that would occur in some years would be expected to be small and would affect areas periodically inundated under existing and No-Action Alternative conditions. The effects of increased flow would diminish with distance downstream. CP2 also would increase the reliability of the water supply by increasing firm water supplies for irrigation purposes, primarily during drought periods. Therefore, implementing CP2 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to but slightly greater than Impact Ag-3 (CP1), because alteration of the flow regime of the Sacramento River would be slightly greater under CP2 than under CP1. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-4 (CP2): Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River Altered flow regimes associated with project implementation under CP2 could adversely affect forest land along the upper Sacramento River. The altered flow regime could affect oak woodland communities by prolonging inundation and changing the availability of soil moisture; however, these effects are speculative, and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of forests in

the riparian corridor along the upper Sacramento River in the future; however, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing CP2 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to but slightly greater than Impact Ag-4 (CP1), because alteration of the flow regime of the Sacramento River would be slightly greater under CP2 than under CP1. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Ag-5 (CP2): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Extended Study Area Within the extended study area, inundation or soil saturation of agricultural lands, including lands designated as Important Farmland and under Williamson Act contract, could result from increased mean monthly river flows. Increases in Sacramento River stage (elevation) would be small. These increased flows would affect areas periodically inundated or saturated under existing conditions or under the No-Action Alternative. The effects of this inundation would diminish with distance downstream. CP2 also would increase the reliability of the water supply by increasing firm water supplies for irrigation purposes, primarily during drought periods. Therefore, implementing CP2 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to but slightly greater than Impact Ag-5 (CP1), because alteration of the flow regime of the Sacramento River would be slightly greater under CP2 than under CP1. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-6 (CP2): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area Altered flow regimes associated with project implementation under CP2 could adversely affect riparian forest and oak woodlands. The altered flow regime could affect oak woodlands by prolonging inundation and changing soil moisture in some years; however, these effects are speculative, and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian forests along the upper Sacramento River in the future; however, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing CP2 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to but slightly greater than Impact Ag-6 (CP1), because alteration of the flow regime of the Sacramento River would be slightly

greater under CP2 than under CP1. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP3 – 18.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply

Like both of the alternatives discussed above, by increasing storage at Shasta Lake, CP3 would change the reservoir's full pool elevation and seasonal pool elevations and the flow regime in the Sacramento River and potentially several other reservoirs and downstream waterways.

The full pool elevation of Shasta Lake would increase by 20.5 feet and the pool elevation would average as much as 18-24 feet higher than under existing (2005) and No-Action (2030) conditions at various times of the year. The greatest change would occur during the wettest years. Raising the dam 18.5 feet would increase the reservoir's surface area at full pool by about 2,570 acres (9 percent). In general, the effect of this increase would be slight, given that the reservoir would exceed the current full pool elevation only during wetter-than-normal years.

In general, the changes in flow and river stage on the upper Sacramento River associated with CP3 would be more substantial than the changes associated with CP1 and CP2. However, these anticipated changes are still within a few percentage points of the changes associated with CP1 and CP2, as outlined above.

Shasta Lake and Vicinity

Impact Ag-1 (CP3): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake No lands adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam are designated by DOC as Important Farmland or under Williamson Act contracts. No impact would occur.

This impact would be the same as Impact Ag-1 (CP1). No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-2 (CP3): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake Inundation of land and removal, modification, or relocation of infrastructure under CP3 would result in the conversion of forest land to nonforest uses. This impact would be significant.

A total of 2,068 acres of forest land would be affected by inundation under CP3 (Table 10-7). Also, approximately 133 acres of land in the relocation areas would be affected by removal, modification, or relocation of infrastructure under CP3 (acreages were calculated based on infrastructure relocation information presented in Chapter 2, "Alternatives"); and most of this acreage would involve conversion of forest land to nonforest uses. This impact would be significant. Mitigation for this impact is not proposed because no feasible mitigation is available to reduce the impact to a less than significant level.

Table 10-7. Acreage of Forest Land that Would Be Affected by Inundation Under CP3

Forest Land	Area (Acres)
Blue oak–foothill pine	16.59
Blue oak woodland	6.81
Closed-cone pine–cypress	484.62
Douglas-fir	0.36
Montane hardwood	371.24
Montane hardwood–conifer	485.20
Ponderosa pine	702.82
Total	2,067.64

Source: Data compiled by AECOM in 2011

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Ag-3 (CP3): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River Within the upper Sacramento River portion of the primary study area, inundation of agricultural lands, including Important Farmland and Williamson Act contract lands, could result from increased mean monthly river flows. In general, the flow increases that would occur in some years would be expected to be small (5 percent or less) and would affect areas periodically inundated under existing and No-Action Alternative conditions. The effects of increased flow would diminish with distance downstream. CP3 also would increase the reliability of the water supply by increasing firm water supplies for irrigation purposes, primarily during drought periods. Therefore, implementing CP3 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to Impact Ag-3 (CP1); however, the extent of the impact would be greater under CP3 than under CP1 and CP2 because it would entail greater alterations of flow regimes. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-4 (CP3): Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River Altered flow regimes associated with project implementation under CP3 could adversely affect forest land along the upper Sacramento River. The altered flow regime could affect oak woodland communities by prolonging inundation and changing the availability of soil moisture; however, these effects are speculative, and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of forests in the riparian corridor along the upper Sacramento River in the future; however, changes in flow regime would not reduce the extent of riparian forest.

Therefore, implementing CP3 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-4 (CP1); however, the extent of the impact would be greater under CP3 than under CP1 and CP2 because it would entail greater alterations of flow regimes. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Ag-5 (CP3): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Extended Study Area Within the extended study area, inundation or soil saturation of agricultural lands, including lands designated as Important Farmland and under Williamson Act contract, could result from increased mean monthly river flows. Increases in Sacramento River stage (elevation) would be small. These increased flows would affect areas periodically inundated or saturated under existing conditions or under the No-Action Alternative. The effects of this inundation would diminish with distance downstream. CP3 also would increase the reliability of the water supply by increasing firm water supplies for irrigation purposes primarily during drought periods. Therefore, implementing CP3 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to Impact Ag-5 (CP1); however, the extent of the impact would be greater under CP3 than under CP1 and CP2 because it would entail greater alterations of flow regimes. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-6 (CP3): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area Altered flow regimes associated with project implementation under CP3 could adversely affect riparian forest and oak woodlands. The altered flow regime could affect oak woodlands by prolonging inundation and changing soil moisture in some years; however, these effects are speculative, and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian forests along the upper Sacramento River in the future; however, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing CP3 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-6 (CP1); however, the extent of the impact would be greater under CP3 than under CP1 and CP2 because it would entail greater alterations of flow regimes. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

Like each of the alternatives discussed above, by increasing storage at Shasta Lake, CP4 would change the reservoir's full pool elevation and seasonal pool elevations, and the flow regime in the Sacramento River and potentially several other reservoirs and downstream waterways.

As under CP3, the full pool elevation of Shasta Lake would increase by 20.5 feet and the pool elevation would average as much as 18–24 feet higher than under existing (2005) and No-Action Alternative (2030) conditions at various times of the year. The greatest change would occur during the wettest years. However, the dedicated Shasta Lake storage of 378 TAF is unique to CP4 and would result in a different drawdown scenario than under CP3. In general, Shasta Lake storage would be 100–140 TAF greater under CP4 than under CP3 at various times of the year, with the greatest difference occurring during October and November. This equates to an increase in pool elevation of about 3 to 5 feet throughout the year.

Raising the dam 18.5 feet would increase the reservoir's surface area at full pool by about 2,570 acres (9 percent). In general, the effect of this increase would be slight, given that the reservoir would exceed the current full pool elevation only during wetter-than-normal years.

The changes in flow and river stage on the upper Sacramento River associated with CP4 would be the same as the changes associated with CP1, as outlined above, in that the operated storage of 256 TAF would be the same for CP1 and CP4.

CP4 includes a gravel augmentation program to restore Sacramento River flow through Anderson Slough, with the primary purpose of recreating habitat for anadromous salmonid fish species.

Shasta Lake and Vicinity

Impact Ag-1 (CP4): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake No lands adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam are designated by DOC as Important Farmland or under Williamson Act contracts. No impact would occur.

This impact would be the same as Impact Ag-1 (CP1). No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-2 (CP4): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake Inundation of land and removal, modification, or relocation of infrastructure under CP4 would result in the conversion of forest land to nonforest uses. This impact would be significant.

This impact would be the same as Impact Ag-2 (CP3) and would be significant. Mitigation for this impact is not proposed because no feasible mitigation is available to reduce the impact to a less than significant level.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Ag-3 (CP4): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River Within the upper Sacramento River portion of the primary study area, inundation of agricultural lands, including Important Farmland and Williamson Act contract lands, could result from increases in mean monthly river flows. In general, the flow increases that would occur in some years would be expected to be small (5 percent or less) and would affect areas periodically inundated under existing and No-Action Alternative conditions. The effects of increased flow would diminish with distance downstream. CP4 also would increase the reliability of the water supply by increasing firm water supplies for irrigation purposes, primarily during drought periods. In addition, there is no Important Farmland or Williamson Act contract land in the area proposed for gravel augmentation. Therefore, implementing CP4 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to Impact Ag-3 (CP1). In addition, there is no Important Farmland or Williamson Act contract land in the area proposed for gravel augmentation. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-4 (CP4): Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River Altered flow regimes associated with project implementation under CP4 could adversely affect forest land along the upper Sacramento River. The altered flow regime could affect oak woodland communities by prolonging inundation and changing the availability of soil moisture; however, these effects are speculative, and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of forests in the riparian corridor along the upper Sacramento River in the future; however, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing of CP4 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-4 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Ag-5 (CP4): Direct and Indirect Conversion of Important Farmland and Cancellation of Williamson Act Contracts to Nonagricultural Uses in the Extended Study Area Within the extended study area, inundation or soil

saturation of agricultural lands, including lands designated as Important Farmland and under Williamson Act contract, could result from increased mean monthly river flows. Increases in Sacramento River stage (elevation) would be small. These increased flows would affect areas periodically inundated or saturated under existing conditions or under the No-Action Alternative. The effects of this inundation would diminish with distance downstream. CP4 also would increase the reliability of the water supply by increasing firm water supplies for irrigation purposes, primarily during drought periods. Therefore, implementing CP4 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to Impact Ag-5 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-6 (CP4): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area Altered flow regimes associated with project implementation under CP4 could adversely affect riparian forest and oak woodlands. The altered flow regime could affect oak woodlands by prolonging inundation and changing soil moisture in some years; however, these effects are speculative, and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian forests along the upper Sacramento River in the future; however, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing CP4 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-6 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP5 – 18.5-Foot Dam Raise, Combination Plan

Like each of the alternatives discussed above, by increasing storage at Shasta Lake, CP5 would increase the reservoir's full pool elevation and seasonal pool elevations and change the flow regime in the Sacramento River and potentially several other reservoirs and downstream waterways.

The full pool elevation of Shasta Lake would increase by 20.5 feet and the pool elevation would average as much as 18-24 feet higher than under existing (2005) and No-Action Alternative (2030) conditions at various times of the year. The greatest change would occur during the wettest years. Raising the dam 18.5 feet would increase the reservoir's surface area at full pool by about 2,570 acres (9 percent). In general, the effect of this increase would be slight, given that the reservoir would exceed the current full pool elevation only during wetter-than-normal years.

Changes in flow and river stage on the upper Sacramento River associated with CP5 would be the same as those associated with CP3, as outlined above.

CP5 includes a gravel augmentation program to restore Sacramento River flow through Anderson Slough, with the primary purpose of recreating habitat for anadromous salmonid fish species. Also under consideration under this alternative are rehabilitation of the boat ramp for motorized boat use and construction of a handicap fishing access area.

Shasta Lake and Vicinity

Impact Ag-1 (CP5): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake No lands adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam are designated by DOC as Important Farmland or under Williamson Act contracts. No impact would occur.

This impact would be the same as Impact Ag-1 (CP1). No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-2 (CP5): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake Inundation of land and removal, modification, or relocation of infrastructure under CP5 would result in the conversion of forest land to nonforest uses. This impact would be significant.

This impact would be similar to Impact Ag-2 (CP3) and would be significant. Mitigation for this impact is not proposed because no feasible mitigation is available to reduce the impact to a less than significant level.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Ag-3 (CP5): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River Within the upper Sacramento River portion of the primary study area, inundation of agricultural lands, including Important Farmland and Williamson Act contract lands, could result from increased mean monthly river flows. In general, the increases in flow that would occur in some years would be expected to be small (5 percent or less) and would affect areas periodically inundated under existing and No-Action Alternative conditions. The effects of increased flow would diminish with distance downstream. CP5 also would increase the reliability of the water supply by increasing firm water supplies for irrigation purposes, primarily during drought periods. There is no Important Farmland or land under Williamson Act contract within the areas proposed for gravel augmentation and improvements to recreational facilities. Therefore, implementing CP5 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to Impact Ag-3 (CP1). In addition, there is no Important Farmland or land under Williamson Act contract within the areas proposed for gravel augmentation and recreational facility improvements. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-4 (CP5): Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River Altered flow regimes associated with project implementation under CP5 could adversely affect forest land along the upper Sacramento River. The altered flow regime could affect oak woodland communities by prolonging inundation and changing the availability of soil moisture; however, these effects are speculative, and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of forests in the riparian corridor along the upper Sacramento River in the future; however, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing CP5 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-4 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Ag-5 (CP5): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Extended Study Area Within the extended study area, inundation or soil saturation of agricultural lands, including lands designated as Important Farmland and under Williamson Act contract, could result from increased mean monthly river flows. Increases in Sacramento River stage (elevation) would be small. These increased flows would affect areas periodically inundated or saturated under existing conditions or under the No-Action Alternative. The effects of this inundation would diminish with distance downstream. CP5 also would increase the reliability of the water supply by increasing firm water supplies for irrigation purposes primarily during drought periods. Therefore, implementing CP5 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to Impact Ag-5 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-6 (CP5): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area Altered flow regimes associated with project implementation under CP5 could adversely affect riparian forest and oak woodlands. The altered flow regime could affect oak woodlands by prolonging inundation and changing soil moisture in some years; however, these effects are speculative, and may not all prove to be adverse. Changes in

the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian forests along the upper Sacramento River in the future; however, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing CP5 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-6 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

10.3.5 Mitigation Measures

Table 10-8 presents a summary of mitigation measures for agricultural and forest resources.

Table 10-8. Summary of Mitigation Measures for Agriculture and Important Farmland

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact Ag-1: Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake	LOS before Mitigation	PS	NI	NI	NI	NI	NI
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	SU	NI	NI	NI	NI	NI
Impact Ag-2: Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake	LOS before Mitigation	NI	S	S	S	S	S
	Mitigation Measure	None required.	No feasible mitigation is available to reduce impact.				
	LOS after Mitigation	NI	SU	SU	SU	SU	SU
Impact Ag-3: Direct and Indirect Conversions of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River	LOS before Mitigation	PS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	SU	LTS	LTS	LTS	LTS	LTS

Table 10-8. Summary of Mitigation Measures for Agriculture and Important Farmland (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4	CP5
Impact Ag-4: Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact Ag-5: Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Extended Study Area	LOS before Mitigation	PS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	SU	LTS	LTS	LTS	LTS	LTS
Impact Ag-6: Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

Notes:

LOS = level of significance
LTS = less than significant
NI = no impact
PS = potentially significant
S = significant
SU = significant and unavoidable

No-Action Alternative

Under the No-Action Alternative, no action would be taken, including implementation of mitigation measures; rather, existing conditions would continue to change into the future. No mitigation measures are required to reduce the indirect effects of agricultural land conversion in the study area under the No-Action Alternative. Thus, Impacts Ag-1 (No-Action), Ag-3 (No-Action), and Ag-5 (No-Action) would be significant and unavoidable.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is needed for Impacts Ag-1 (CP1), Ag-3 (CP1), Ag-4 (CP1), Ag-5 (CP1), and Ag-6 (CP1). No feasible mitigation measures are available at the time of preparation of this PDEIS to reduce Impact Ag-2 (CP1) to a less than significant level (i.e., to mitigate conversion of forest land to nonforest uses in the vicinity of Shasta Lake). Therefore, Impact Ag-2 (CP1) would be significant and unavoidable.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is needed for Impacts Ag-1 (CP2), Ag-3 (CP2), Ag-4 (CP2), Ag-5 (CP2), and Ag-6 (CP2). As discussed above for CP1, no feasible mitigation measures are available at the time of preparation of this PDEIS to reduce Impact Ag-2 (CP2) to a less than significant level (i.e., to mitigate conversion of forest land to nonforest uses in the vicinity of Shasta Lake). Therefore, Impact Ag-2 (CP2) would be significant and unavoidable.

CP3 – 18.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply

No mitigation is needed for Impacts Ag-1 (CP3), Ag-3 (CP3), Ag-4 (CP3), Ag-5 (CP3), and Ag-6 (CP3). As discussed above for CP1, no feasible mitigation measures are available at the time of preparation of this PDEIS to reduce Impact Ag-2 (CP3) to a less than significant level (i.e., to mitigate conversion of forest land to nonforest uses in the vicinity of Shasta Lake). Therefore, Impact Ag-2 (CP3) would be significant and unavoidable.

CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

No mitigation is needed for Impacts Ag-1 (CP4), Ag-3 (CP4), Ag-4 (CP4), Ag-5 (CP4), and Ag-6 (CP4). As discussed above for CP1, no feasible mitigation measures are available at the time of preparation of this PDEIS to reduce Impact Ag-2 (CP4) to a less than significant level (i.e., to mitigate conversion of forest land to nonforest uses in the vicinity of Shasta Lake). Therefore, Impact Ag-2 (CP4) would be significant and unavoidable.

CP5 – 18.5-Foot Dam Raise, Combination Plan

No mitigation is needed for Impacts Ag-1 (CP5), Ag-3 (CP5), Ag-4 (CP5), Ag-5 (CP5), and Ag-6 (CP5). As discussed above for CP1, no feasible mitigation measures are available at the time of preparation of this PDEIS to

reduce Impact Ag-2 (CP5) to a less than significant level (i.e., to mitigate conversion of forest land to nonforest uses in the vicinity of Shasta Lake). Therefore, Impact Ag-2 (CP5) would be significant and unavoidable.

10.3.6 Cumulative Effects

California's demand for water for irrigation and other uses is expected to continue to increase, while the water supply will likely become less reliable. This trend could lead to increased pressure to convert Important Farmland to other nonagricultural uses and cancel Williamson Act contracts, resulting in an indirect impact; this indirect impact would be potentially significant.

No operational changes would occur that would directly convert forest land to nonforest uses along the upper Sacramento River. However, CVP and SWP water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlargement of Shasta Dam. The resulting changes in flow regime would likely result in minimal adverse effects on riparian forest and oak woodlands. Several management and restoration plans and programs would implement actions that would largely offset those adverse effects. Although there would be reasonably foreseeable projects that would restore forest land or put land into agricultural production, there would be an overall significant cumulative effect on Important Farmlands and forest lands.

The effects of climate change on operations at Shasta Lake could potentially result in changes to conditions for agricultural land and forest land in downstream areas. As described in the Climate Change Projection Appendix, climate change could affect future demand for agricultural water by leading to increased rates of evapotranspiration and increasing the length of the growing season. On the other hand, increased precipitation could decrease overall water demand, depending on what adaptation strategies are used by agriculture and municipalities and how much more efficiently plants use water when carbon dioxide concentrations are higher. Changes in crop type, planting cycles, time of planting, and crop productivity may occur as the result of climate change, though consensus has not been reached on how changes will occur. As stated previously in this section, increases in California's demand for water and forecast reductions in water supply could lead to increased pressure to convert Important Farmland to other nonagricultural uses and cancel Williamson Act contracts.

In addition, changes to forest land and land cover could affect climate change. As stated in the Climate Change Projection Appendix, deforestation and land cover conversion have also been identified as contributing to global warming by reducing the Earth's capacity to remove carbon dioxide from the air and altering the Earth's albedo or surface reflectance, allowing more solar radiation to be absorbed.

In the primary study area, forest land would be affected by inundation of land and removal, modification, or relocation of infrastructure in the vicinity of Shasta Dam. Implementing any of the five project alternatives (CP1–CP5) would result in the conversion of forest land to nonforest uses in the vicinity of Shasta Dam. No feasible mitigation exists to create a similar large area of forest land to replace the area of forest land that would be inundated or converted to nonforest uses by relocation of facilities. Therefore, each of the five project alternatives would result in a cumulatively considerable incremental contribution to a cumulative impact related to conversion of forest land to nonforest uses. However, it is determined that there is not an overall significant cumulative impact related to conversion of forest land to nonforest uses because most of this area remains substantially in forest land and has not been converted to nonforest uses. Therefore, this impact would not be cumulatively significant.

In the extended study area, altered flow regimes associated with implementation of any of the five project alternatives could affect forest land. The altered flow regime could affect oak woodlands by prolonging inundation and changing the availability of soil moisture in some years; however, these effects are speculative, and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian forest along the upper Sacramento River in the future; however, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing any of the five project alternatives would not result in the conversion of forest land to nonforest uses. Therefore, the five project alternatives would not result in a cumulatively considerable incremental contribution to a significant cumulative impact related to conversion of forest land to nonforest uses.

As stated previously climate change could result in changes to conditions for agricultural land and forest land in downstream areas. However, implementing any of the five project alternatives would promote improvements in the reliability of CVP water supply deliveries. Thus, the project alternatives would not result in a cumulatively considerable incremental contribution to a significant cumulative impact related to future demands for agricultural water.

The five project alternatives would result in a cumulatively considerable incremental contribution to a cumulative impact related to conversion of forest land to nonforest uses; however, there is not an overall significant cumulative impact related to conversion of forest land to nonforest uses because most of this area remains substantially in forest land and has not been converted to nonforest uses. Thus, when added to the anticipated effects of climate change, raising Shasta Dam would not have a significant cumulative effect on climate change resulting from changes to forest land and land cover.